18. *P. indigotica*, Cooke & Peck. . . . *N. Y.*, p. 83.
19. *P. cucurbitaria*, Cooke. . . . *N. J.*, p. 84.
20. *P. dispersa*, Gerard. . . . . *N. Y.*, p. 84.

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21. *Cenangium triangulare*, (Schw.). *N. J., Mass.*, p. 114.
22. *Phacidium crustaceum*, B. & C. . . *Mass.*, p. 115.

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23. *Phacidium autumnale*, Fckl. . . . *Iowa*, p. 131.
24. *Patellaria ferruginea*, C. & E. . . *N. J.*, p. 150.

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25. *Phacidium dentatum*, Schmidt. . . *N. Y.*, p. 155.

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26. *Discella discoidea*, C. & P. . . *N. Y.*, p. 170.
27. *Phacidium carbonaceum*, Fr. . . *N. Y.*, p. 172.
28. *Discella leguminum*, Cooke. . . *Texas*, p. 174.
29. *D. macrosperma*, Peck. . . . . *N. Y.*, p. 174.
30. *Eustegia, Magnoliae*, Peck. . . *S. Car.* p. 175.
31. *Patellaria, lignyota*, Fr. . . . *N. J.*, p. 175.

New Bedford, Mass. H. W.

**Nutation in Epilobium angustifolium,** L.—This plant, which is put down in the botanies as willow-herb, but is more frequently called fire-weed, exhibits the phenomenon of nutation in a very marked and interesting manner. The young flowers-buds at the tip of the raceme are erect. A little later, as the stem (axis of inflorescence) elongates, they point downwards and are closely pressed against the stem. Still later, the peduncles of the half-grown flower-buds begin to rise, and soon form nearly a right angle with the stem. Later still, when the buds are fully developed and begin to open, the angle is lessened to about forty-five degrees; while the fruits, when mature, are, for the most part, nearly or quite erect. Thus the flowers, or at least the ovaries, from the time of their formation to their fruiting, traverse, twice over, the arc of a circle of nearly ninety degrees. What advantage the plant gains by these movements it might be difficult to say. Possibly the movements may have some relation to those which are known to pertain to the stamens and style. Observations during the growing season, by any one having the opportunity, would no doubt bring out some interesting facts.

Cornell University. A. N. PRENTISS.

**Growth of Exogens. III.**—This subject is one of such importance to science that I feel anxious to put before the botanists of the country all the information that comes into my possession.

In a conversation with one of the professors of Washburn College, Topeka, Kansas, on the growth of Exogens, he informed me that for some years he had charge of the trees upon the college grounds.

In order to get shade as soon as possible, the cottonwood (*Populus monilifera*) had been set alternating with other trees, with the design of removing the cottonwoods as they grew large enough to interfere with the growth of the more desirable trees.

In that locality a dry season occurs with marked constancy, be-

ginning about the first of July and ending about the first of September, while September is usually a wet and warm month. In watching the remarkable growth of the cotton-woods, the professor's attention was drawn to what he thought was a check in their activity in the latter part of the dry season, and the pushing of the terminal buds in September and early October. He became deeply interested in what he regarded as an abnormal condition, and watched with great care until he was convinced that a new, or second tube of wood was formed during this second growth. To test the matter fully he examined cross-sections of some branches whose age he knew, and found that the number of concentric rings exceeded the number of yeárs they had been growing.

In 1877 the dry season set in earlier, commencing about the 20th of June and ending about the 10th of September. This year was peculiarly well suited to testing the truth of second growth, as the dry season was succeeded by wet and warm weather. As soon as frost set in and vegetable growth had ceased, he made cross-sections of several young branches and found that two distinct tubes of wood had been added during the year.

In further proof of the second growth hypothesis, I add the observations and experiments of Désiré Charnay, who is now exploring the ruins of Central America. He had grave doubt as to the great antiquity assigned to some of the ruins that had been laid bare ; and he learned, moreover, that the conclusions had been arrived at by counting the rings in the cross-sections of large trees which had grown upon the ruins, some of which exhibited rings enough to indicate that the trees were 2,000, 2,500 and even 3,000 years old—calculating upon the basis that one ring is made in a year. Mr. Charnay, had his attention drawn to the investigation of the one ring theory in cutting down a sapling which he knew to be eighteen months old, and on whose cross-section he counted 40 concentric rings, making more than two for every month of the plant's life. These observations were followed up by Mr. Charnay, with the same comparative result, *i. e.*, that more than one tube of wood is made during the year ; hence he was forced to the conclusion that no reliance could be placed upon that mode of determining the date of the ruins.

On a careful examination of the mangrove I was led to the belief that exogenous growth in regions of no frost is very different from that in the regions of frost, where most of our trees make but one *distinct* ring. I am sure that most of them during some seasons make indistinct rings.

The mangrove puts forth a very vigorous growth, then rests apparently from exhaustion, having formed terminal buds in all its branches. After a short period of rest it pushes its buds and a new growth takes place ; then, after another period of great activity, there ensues another rest, and so on. In each case a new tube is formed, so that two or many may be made in a year.

I have procured from Southern Florida and Southern Texas specimens of many sorts, all of which confirm my belief in the hypothesis that our exogens in regions of frost, as well as in the Tropics may,

and frequently do, make two or more distinct tubes of wood in one growing season.

White Plains, N. Y. O. R. WILLIS.

**Concentric Annual Growths.**—There is no connection between the longitudinal (branch) growth of plants, and the generation of the cells which form the annual layers of wood in the trunk. *Quercus Robur* often has two distinct periods of longitudinal growth the same season in Europe, and in our country nearly always three—but I have never seen more than twelve annual circles of wood in a twelve-year old tree, though I have seen and counted many when cut down for poles at that age.

THOMAS MEEHAN.

**Teratological Notes.** (From observations made during the season of 1881).—*Symplocarpus foetidus*, Salisb., with two spathes, one within the other, the opening of the inner facing the back of the outer; no spadix. Also a specimen of the same plant with a tuft of well-developed leaves from the centre of the spathe, in place of the usual spadix.

*Podophyllum peltatum*, L., with a single peltate leaf, having a flower-bud about one inch below it, and with one of the bud-scales at the surface of the ground bearing at its summit a small sub-peltate leaf. Also a specimen of the same plant with three peltate leaves; two of these forking above the insertion of the first, and bearing the flower in the axil.

*Hepatica triloba*, Chaix., with four involucral leaves, the outer of which was enlarged, and evidently three-lobed.

*Claytonia Virginica*, L., with unequally bifid, or slightly laciniate petals.

*Houstonia caerulea*, L., one flower having six sepals and six petals, and two or more flowers with five sepals and petals, growing close together, but not from the same root. The six-parted one had also a four-parted flower on a branch of the same stem. Also, in another locality, a plant with a three-parted flower.

*Ranunculus bulbosus*, L., with the principal stem flattened, about one-half inch wide, and terminating in a distorted head of fruit.*

Also a scape of *Taraxacum* deformed in a very similar manner to the above.

*Plantago lanceolata*, L., bearing two diverging spikes from the summit of the same scape.

*Vesbascum*; evidently a hybrid, and probably *V. Blattaria*, L., fertilized by *V. Lychnitis*, L. It had the general appearance of the former, but tended to branch more paniculately, and to have more flowers (about 4) from the axil of the same bract. The stem was slender, with the leaves more tapering and more woolly than in the last, and the flowers were also slightly less. The pods did not seem to develop fully, and, as far as observed, no seed perfected.

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* Fasciation in this species, as well as in *repens* and *arvis*, was more than ordinarily common in the vicinity of New York last spring.—EDS.